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The Influence of Body Mapping on Student Musicians' Performance Experiences

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Abstract

This qualitative study examines student musicians' perceptions of their performance and development resulting from Body Mapping (BMG) technique. BMG is a somatic (mind-body) education technique designed to teach musicians skills in self-evaluation and change for performing with sensory-motor integrity. A qualitative study guided by an interpretive framework was used to collect data from undergraduate students and faculty at an American university. Data involved in-depth interviews, self-reflective journals, and course materials. The findings show BMG played a multi-faceted role. The majority of the students reported a positive experience, stating that BMG enhanced their ability for musical expression (e.g. dynamics, phrasing, conveying emotional information), the ability to focus more easily on elements contributing to expressive outcomes, and facilitated greater personal confidence in being more musically expressive. The study discusses how

BMG instruction can be used for enhanced technical and performance outcomes. The research findings are relevant for musicians, educators, and health practitioners in the field of music medicine.

Introduction

Effective movement is paramount in music-making due to the highly refined and intensely repetitive nature of performance. Simply stated, musical performance is physically demanding, as well as intellectually and emotionally exacting. The fine-motor coordination skills developed by musicians also require them to move in ways that are potentially more injurious than the predominantly gross-motor movements executed by professional athletes and dancers (Conable 2003; Horvath 2002; and Mark 2003). Wu et al (2009, p. 371) confirms that ‘efficient sensorimotor integration is essential for music performance.’

For musicians at all stages of their development numerous factors may contribute to the potential ‘perfect storm’ of conditions that result in either technical limitations, or playing-related pain and injury. While the statistics for playing-related pain and injuries vary they share the common element of unnecessarily high numbers. Within the literature, injury rates as high as 82% (Fishbein, Middlestadt, Ottai, Strauss and Ellis, 1998), and 80% (Zara and Farewell 1997) are cited in earlier studies. Unfortunately, recent research continues to report unacceptably high adverse injury and health statistics. For example; a 2011 Danish study reported playing-related pain at 83% for female and 97% for male professional orchestral musicians (Paarup, Baelum, Hold, et al 1997) while 86% of professional instrumentalists reported pain in Great Britain (Leaver, Harris and Palmer, 2011). Among younger musicians, a more recent Australian study found that 67% of instrumental students aged 7–17 experienced playing-related pain (Ranelli, Straker and Smith, 2011). While the underlying reasons may vary, these studies confirm that large numbers of musicians have and continue to encounter problems in their performing related to the physicality of the instrument and their biomechanical use for producing the desired musical sound.

Through advances in research and pedagogy, including a commitment to best practice in music medicine and music education, a clearer understanding and increased awareness about the impact of performance on the human body has emerged (Palac, 2008, Schippers 2007). Investigating the issue of how best to train musicians to ensure optimal performing skills should be inclusive of sound pedagogical practices and a focus of ongoing research.

Empowering musicians with the knowledge and skills for mindful music-making free from biomechanical deficits is both the goal and the solution. The focus of this study is on student musicians’ perceptions of their performance and development as a result of exposure to Body Mapping (BMG), an innovative teaching approach that addresses movement quality in

musicians.

Body Mapping

Somatic educators study and teach the practical relationships of the mind and body in action (Conable 2003). Body Mapping (BMG) is one of the most recent disciplines to enter the field of somatic education, and is the only one currently with a primary focus on the movement needs of musicians. BMG has been in existence since the 1970's and the work of neuroscientists confirms the existence and importance of the body map as described by Conable (Nichols 2004). Body maps are neural networks that represent the anatomy of the body and are located ubiquitously in the brain (Blakeslee and Blakeslee 2007). Harscher (2010, p. 30) explains body maps as 'the internal representation on the cortical surface of our brains that govern[s] all movement'. Nichols (2009, p.15) describes the importance of accurate cortical representations for musicians as follows:

The maps in the executive areas of the cortex that represent the anatomy of the body are clearly dependent upon the motor and sensory experiences of the individual. In the case of a highly trained artist such as a musician, it is expected that the cortical areas become reorganized in a way that reflects the motor planning practices of that individual... Some motor practices can, however lead to pathological changes in the musculoskeletal system, such as tendonitis or carpal tunnel syndrome. If movement is based on an inaccurate knowledge or perception about the anatomy of the body, then pathologic changes can result. These practices can lead to alterations in cortical representation, which can then become reinforcing of the faulty motor practice.

The underlying premise of BMG is the importance of understanding the neurophysiological connections in the human body that lead to freedom of movement. In addition to cultivating accurate and adequate body maps, the integration of kinesthesia into sensory awareness, and the development of inclusive awareness provide musicians with the skills for embodied performing (Johnson 2009; Malde, Allen and Zeller 2009; Pearson 2006 and Vining 2008).

The quality of musical movement is directly affected by issues such as pain, physical alignment, tension and overuse, and failure to address the adequacy and accuracy of the body map results in inefficiency, distortion and injury. In other words - a failure of movement quality (Conable 2003, Gilmore 2005; Johnson 2009; Mark 2003; Nesmith 1999 and Vining 2008). The highly refined, repetitive and specialized movements employed by musicians' when playing an instrument, singing, or conducting, places them in a high-risk category for injuries resulting from poor quality movement and misalignment (Ackermann 2010; Marxhausen 2003; Smith and Sataloff 2000). The integrity of musical movements is

determined by the accuracy and adequacy of body map information (Johnson 2009, Vining 2008). Musicians with inaccurate and inadequate body maps will be affected in varying degrees, with performance limitations at the lesser end of the spectrum and debilitating injuries in the worst case scenarios (Harscher 2010; Mark 2003). Music medicine is a viable option and should be the first step for musicians in pain. However, while music medicine is typically successful in the treatment of medical conditions, unfortunately the majority of playing-related injuries sustained by musicians are movement related and non-medical in cause, hence the difficulties for musicians seeking traditional medical remedies (Liker 2003; Mark 2003). For example, Winspur and Warrington (2010, p. 229) state: ‘experience shows us that only 4% of musicians’ hand and arm problems are of a surgical nature’. The success of treatments where musicians’ are re-trained in their body usage, which also allows for improved technique in performance, is gaining in credibility and popularity within both the musical and medical communities (Liker 2003). Retraining movement patterns is central to a musician’s technique, and adopting a team approach with collaboration between physician, teacher, performer and other health practitioners for the treatment of musicians is also currently recommended by the leading arts medicine physicians.

Poor technique must be identified and corrected, or recurrent problems are likely even if the present situation resolves. A healthcare provider knowledgeable in musculoskeletal function and a music teacher, working together, are more likely to identify potential problems in technique than either working alone. (Brandfonbrener 2010 p. 25)

The literature establishes the importance of BMG for musicians wishing to enhance their technical capabilities and prevent performance-related pain and/or injuries, and explains the means by which BMG principles should apply. Thus it provides a foundation for educators to teach musical technique in combination with movement training. Through BMG techniques, teachers and performers can find a common language that translates into the movement needs of their area of pedagogical focus.

The major significance of this study is the importance it assumes as the first of its kind in the field of BMG. It documents student musicians’ perceptions, opinions, and thoughts on the influence of BMG on their musical performance outcomes and development.

Methodology

The question of the methodological impact of BMG in this study was implicit in the primary research question: ‘How are student musicians’ perceptions of their performance and development influenced by BMG?’ Qualitative research using an action research methodology guided by an interpretive framework was used to collect data from 12

undergraduate students at an American university. A qualitative methodology was selected due to its suitability for the area of enquiry and the nature of the research question – requiring ‘an in-depth understanding of meaning’ from the perspective of the participants (student musicians) in an area (BGM) where there is little known research (Minichiello, Sullivan and Greenwood 1999). The potential of qualitative research for providing information that ‘cultivates better understanding’ of the problems facing musicians is also acknowledged by Manchester (2011, p. 64).

In relation to this study, the notion of action research as ‘self-reflective practice’ is consistent with the fundamental teaching practice of BMG, which is a self-enquiry educational method (McNiff and Whitehead 2002 p.5). Action research is an ‘holistic’ and ‘humanistic’ approach to research wherein the personal experiences of participants is valued (Owens, Stein and Chenoworth 1999). This is congruent with the teaching approach for BMG, which begins with determining what musicians already know about their movement and subsequently seeks to clarify the somatic information governing an individual’s body use. Ultimately action research was chosen for the following four reasons. Firstly its suitability with the educational context of the study; secondly, the need for a methodology that would locate the instructor with the study; thirdly, the Instructor-researcher’s ability to gain access to information contributing to the participant’s perceptions of BMG that would enhance her professional practice; and lastly the researcher’s desire to contribute information of benefit for other practitioners and students in the field of BMG.

Because BMG is a concept that has both cognitive and physiological components, the interpretive framework in this BMG study allowed the Instructor-Researcher to examine connections between theory and analysis via the question ‘do subjective experiences (perceptions) rate as importantly as physiological (actual) experiences?’ Evaluation of the data via an interpretive framework allowed investigation into the ways those components were interpreted and used by the students. It also permitted examination of the connections they made in terms of the physical improvements they believed they saw, such as more efficient breathing resulting in an improved tone quality, or more finely attuned motor coordination that facilitated more expressive and controlled playing. The interpretive framework also allowed the Instructor-researcher to understand how the students evaluated themselves within the context of their observations, thus redefining how their body use allowed them to become better musicians.

Research Study Design

The participants in this study comprised 12 undergraduate students, and 10 music faculty at a University in the United State of America. All participants were volunteers, and the students were a convenience sample drawn from the class of 20 students enrolled in a three-credit

elective performance enhancement course taught by the Instructor-researcher during a Spring Semester (mid-January to early May). The student participants comprised four males and eight females, and the gender balance within the School of Music at the time of the study was approximately 55% female and 45% male. The performance areas represented were (in alphabetical order) bassoon, conducting, euphonium, flute, organ, piano, violin and voice. Eleven of the students were undergraduate music majors and one was an undergraduate art and design major with a strong interest and background in musical performance. The distribution of year levels revealed five sophomores (2nd year), four juniors (3rd year), and three senior (4th year) students.

Ten music faculty members also participated in the study with one faculty member agreeing to comment on progress of three students, while the remaining nine had one student each in the study. The faculty gender distribution was equal, with five males and five females. Four faculty members were full-time tenure track while six were visiting specialists (part-time or adjunct teachers). The faculty participants were primarily studio teachers (vocal and instrumental), and there were also some ensemble conductors. Table 1 shows the study participants by alias, their *results group (RG)* designation, performance area, year level, and their faculty member (also an alias).

Table 1. Research study participant summary

Student Participant	Results Group	Performance Area	Year Level	Faculty Member
Susan	Good	Voice	Senior	Owen
Sonya	Good	Violin	Junior	Kyle
Natalie	Good	Flute	Sophomore	Patricia
Adelaide	Good	Piano	Sophomore	Roslyn
Amy	Good	Bassoon	Junior	Tanya
Howard	Good	Organ	Senior	Harold
Tyler	Reasonable	Conducting	Senior	Hamish
Ingrid +	Reasonable	Voice	Sophomore	Owen
Andrew	Reasonable	Euphonium	Junior	Colleen
Alison +	Minimal	Piano	Sophomore	Owen
Rachel	Minimal	Voice	Junior	Dorothy
Vance	Minimal	Voice	Sophomore	Lawrence

Data Collection

The tools used for data collection were a combination of study-specific methods (journal and in-depth interviews) and documents and information obtained from the BMG class (*Background Information questionnaire, Agenda Helper, video-taped performances, and Instructor-researcher field notes*). These methods of data collection were specifically chosen for their suitability and manageability in this specific class setting. Self-reflective journals and in-depth interviews were the two main methods of data collection employed to identify the different functions that BMG played in students' perceptions of their musical performance and development. Additionally, all students video-taped their in-class performances during the semester so they had a point of reference for their practical progress over time. The video-tapes were viewed and critiqued by the students as part of their self-analysis in the learning process. The Instructor-researcher also kept copies of field notes made during classroom interactions with the students, specifically performance critique notes made during practical rotations and the final assessment presentations.

Course documents such as the *Background Information Questionnaire* and *Agenda Helper* were also used, as well as copies of emails/letters and other course documents given to the researcher by students for use in the study. For example, one student asked to include pictures she drew for her final class presentation in her study file. The *Background Information Questionnaire* was completed on the first day of class and comprised open-ended questions designed to give the Instructor-researcher an understanding of the students' previous experiences, possible playing-related health issues, and motivation for taking the course. The *Agenda Helper* was an eight-page diagnostic tool that was distributed to all members of the class, not just study participants. It was completed twice during the course. Firstly at the conclusion of the presentation of the theoretical information and prior to their individual coaching sessions (semester mid-point), and again at the end of the semester at the conclusion of their final performance-presentation. The *Agenda Helper* was an eight-page document comprising a comprehensive list of specific questions designed to probe students' understanding of BMG concepts and their perceived level of skill application. Used correctly, the *Agenda Helper* was a valuable analytic tool for confirming comprehension of concepts, pinpointing areas working well, and identifying issues requiring attention.

In this study, self-reflective journals were maintained by student participants to record evidence of their development, their thinking, and feelings about their progress over the course duration. Participants were asked to focus on their development at three specific stages of the course, including: 1) the beginning of the semester prior to the introduction of the theoretical BMG information; 2) midway through the semester when all of the theoretical content had been taught; and 3) towards the end of the semester when they were engaged in practical skill development and application focused on integrating the BMG information with

their musical performing. Beyond this the content, format, and style of the journals were left open to individual taste and style in order that participants would feel comfortable expressing themselves freely.

For administrative and expediency purposes, all journals were submitted electronically via email to the instructor-researcher on a weekly basis. The content of many journal entries was rich with information explaining complex and sensitive emotional, musical, and intellectual struggles, and in a few cases they contained personal information that went far beyond the scope of the study. Although journals were to be submitted on a weekly basis, for some participants the regularity of submission varied owing to issues relating to health, class attendance, and other life stresses. In addition to giving the instructor-researcher a clear picture of individual progress throughout the course of study, data in the journals also generated specific information incorporated into the questions for each student's in-depth interview.

In-depth interviews were conducted for gaining a breadth of subtle and detailed information about the meanings and interpretations that participants ascribed to their life experience (Fontana and Frey 2000; Minichiello, Aroni and Hays 2008). Interview information also served as the 'methodological core' against which other study data (journal entries and observations) were used as the basis of information and themes for discussion in the in-depth interviews (Agar 1980, cited in Mills 2003 p.169). For the purposes of this study, a form of semi-structured in-depth interview with recursive questioning was conducted with all study participants at the end of the semester. Interviews were conducted in an informal, conversational style, beginning with a basic schedule of questions common to each participant, and quickly evolving into more open-ended questions that were unique to each participant and their experience.

The specific questions developed for each student were devised by the researcher in response to information provided via the self-reflective journals and classroom interactions (including performances). Individual interview questions were designed to clarify or deepen the researcher's understanding of the participants' insights and experiences. In addition to the discussion generated from information presented in the above-mentioned data sources, significant information was obtained from each participant during the course of the interview conversation.

For faculty participants, the interview questions focused on their observations of any changes or development in their student's musical development or performance during the semester. Student-provided information that specifically referenced their teacher, and/or a particular learning or musical situation that required amplification was also discussed. Some of the

topics explored included their familiarity with somatic disciplines and BMG, level of comfort with their students exploring other areas of information, the nature of their student-teacher relationship, and the extent to which their student discussed BMG course information with them. As with the student in-depth interviews, a recursive style of questioning was employed to maintain the natural flow of information in the conversation. This included probes to explore the reasons for answers either generally or in response to student development.

All students in the BMG course were required to video-tape themselves in performance during the semester and analyze their progress, regardless of their study participation. Objective analysis as part of the process of self-inquiry was an important facet of the learning experience and use of videotapes by musicians to record and evaluate performance and growth is commonplace. Students video-taped themselves performing in class three times during the semester: at the very beginning of the semester prior to any BMG teaching; at the mid-point of the course; and at the conclusion of the semester. The purpose of the video-taping was primarily for students to analyze their progress as part of the process of self-inquiry. They were also available for the faculty participants to view if requested.

The time-frame for data collection was determined by the duration of the semester (15 weeks), and the access the researcher had to informants during that time and at the conclusion of the academic year. Since a number of student participants were graduating and moving out-of-state, and some faculty were leaving for professional engagements overseas, the window of opportunity for the in-depth interviews was comparatively small, i.e. four weeks after the semester concluded. The reflective journals written by the students were submitted over the 15 weeks of the semester, with some students continuing to send updates on their progress over the summer months of their own volition.

Data Analysis

Uncovering the meaning in the participants' experiences was the focus of the data analysis. In this study it was the instructor-researcher's intention to initially approach the data inductively in order to allow the study themes to emerge from with the data without preconceptions. The priority was on keeping an open mind for the ways the students' described their experiences.

Assessing the interaction between induction and deduction was an integral part of the analytic process. While the instructor-researcher acknowledges the potential for fallibility in the interpretation of the data and the influence of her own experiences with the study information, this should not detract from study outcomes. Rather, it is integral to the teaching-learning process which is central to this study. Further, it is supported by the context of practical action research which recognizes the importance of the instructor-researcher as a participant

in the research process. Finally, through the constant checking and cross-checking of data in the thematic analysis process, as well as the validation of information supplied by independent music faculty study participants, the student research data was subjected to a rigorous analytical process that sought to maintain clarity in the instructor-researcher's interpretations.

Analysis of student participant data began in the first week of the semester when the instructor-researcher received their *Background Information Questionnaire* (course document) at the end of the second class. Submission of weekly journal entries also began at the end of the first week of the course which enabled ongoing data analysis during the course of the semester. During the first stages of student journal analysis the instructor-researcher themes began to emerge that were important for both individual and collective student experiences, such as tension, frustration, pain, awareness, improvement and balance. The journals provided key narratives and insights into the students' thinking and experiences. They also provided important information for the formulation of specific issues that were addressed in the end-of-study in-depth interviews. The in-depth interviews yielded information regarding the totality of the students' experience in particular reflections on the context for their study experiences. Hence the acquisition of information and cultivation of skills was understood through the lens of considered self-analysis and other self-reflective practices.

Data Coding

In this study the instructor-researcher followed the coding procedures described by Strauss and Corbin (1998). The principles of open, axial and selecting coding for thematic analysis were employed and follow grounded theory. During open coding, the first stage of thematic analysis, data was analyzed into concepts or themes from within the data. This process required detailed examination of the data through line-by-line analysis of text, analyzing whole sentences or paragraphs for meaning, and also reading entire sections to understand the context of the information. Examples of concepts included 'anxiety', 'enjoyment', 'experimentation', 'improvement', 'pain', 'breakthroughs', and 'balance'.

The second stage of thematic analysis was axial coding which is described by Ezzy (2002) as the process of exploration of the codes identified in open coding by examining the relationships between them. Determining how codes may be linked or connected enables the researcher to deduce relationships within code categories and the conditions or processes that contributed to those relationships. Axial coding allows the researcher to form more precise and complete explanations about study phenomena, which contribute to understanding the relationship between process and structure. Development of mini-frameworks to show the emerging connections between broader ranges of phenomena was also undertaken.

Selective coding is the final stage in thematic analysis when the 'identification of the core

category or story around which the analysis focuses’ becomes evident (Ezzy 2002 p.92). *Process* was the central theme that emerged from the data for this study. Table 2 illustrates the selective and axial coding of the data and shows the way concepts interrelated. For example, the sub-category *balance* is a key element of the *physical* dimension of re-mapping which is a major component of *process*. *Balance* also interacts with the other axial categories of *challenges*, *problems*, *discovery* and *changes*.

Table 2. The selective and axial coding of the data

Core Coding	Secondary Coding	Axial Coding (sub-categories)
PROCESS	COGNITIVE Understanding & Awareness	<ul style="list-style-type: none"> ▪ Information assimilation ▪ Self-analysis ▪ Experimentation ▪ Observations of others ▪ Observations of self ▪ Habits-of-mind (questioning, synthesis, analysis, evaluation) ▪ Connections (studio teacher, other)
	PHYSICAL Re-mapping process	<ul style="list-style-type: none"> ▪ Balance ▪ Challenges ▪ Problems (tension, pain, injury) ▪ Discovery ▪ Changes (time)
	EMOTIONAL State-of-mind	<ul style="list-style-type: none"> ▪ Attitude (positive, excited, frustrations) ▪ Mind-set (expectations, confidence, progress-improvements) ▪ Journey (perceptions, consistency) ▪ Success (achievements)

Data Presentation

Results Groups Typology

Jay and Johnson (2002) describe a typology as providing a framework for discussion and action of a concept or phenomenon. Robinson and Bennett (1995, p. 557) identify a typology as ‘useful for developing broader measure of identification’ and thus ‘enabling empirical test of our theories’. Holstein and Gubrium (1994, p. 263) describe the development of *typifications* which ‘make it possible to account for experience, rendering this and occurrences recognizable as being of a particular type of realm.’ Furthermore, they classify typifications as ‘indeterminate, adaptable, and modifiable. In other words, the development of information or results into defined categories (typologies) is possible within a particular body of knowledge. Moreover, the content of typologies is constantly evolving as a result of new information and

interpretations of that information. Use of the *results group* (RG) typology provided a basis for comparison of results within the student cohort in this study.

Within the data three categories of student experience emerged and the typology developed by the instructor-researcher was in the paradigm of performance results. Hence the terminology *results groups* (RG). The titles for each RG – *good*, *reasonable* and *minimal* – were developed using language that was of practical significance because it described the students' overall degree of success with applying BMG information to their performance area (Fink 1995; Kemmis and McTaggart 2000). Students in the *good RG* achieved consistently successful results; students in the *reasonable RG* experienced varying degrees of success; and students in the *minimal RG* had either generally inconsistent or unsuccessful results in the application of BMG to their performing.

Results

Knowledge and Understanding of Body Mapping Principles

The ultimate goal of this study was to assess the effectiveness of the students' BMG learning process by how successfully they were able to integrate information into the practical application skills required for their area of musical performance. Since the ability to cultivate practical skills requires understanding of foundation concepts, it was vital the instructor-researcher determined the extent to which all participants understood the theoretical principals governing adequate and accurate movement. Across all *RGs* there was consistency with the level of confidence in understanding BMG concepts, with responses ranging from 'very comfortable' to 'I'm pretty proficient.' Additionally, the data also determined that irrespective of their RG designation, the majority of students believed BMG was of significant value as a discipline and tool for musicians.

Ability to Integrate Body Mapping Information into Own Usage

The ability to integrate BMG techniques into performance usage proved more challenging and this was a criteria by which participants were notably separated in *RGs*. Overall student self-assessments of their ability in this area were also lower than their responses for the acquisition of knowledge. These results were consistent with the instructor-researcher's previous experience of student learning wherein it takes more time to successfully develop and master a practical skill than it does to grasp a theoretical concept. In the *reasonable* and *minimal RGs* in particular, the data revealed a clear distinction between the students' theoretical competence, and their confidence and success with practical application.

Body Mapping as a Tool for Enhancing Musical Expression

A person's ability to be musically expressive is dependent on a number of elements. These include technical skills, musical imagination and ideas, and the ability to convey the conventions of expression through phrasing, changes of dynamics, tempi, and timbre (tone color). Figure 1 summarizes the students' perceptions of the influence of BMG on their ability to be musically expressive. The nine students who strongly believed BMG had enhanced their ability for musical expression comprised the *good* and *reasonable RGs*. Common responses included the ease of movement that facilitated expressive outcomes (e.g. dynamics, phrasing, emotional information), and the ability to focus more easily on elements that contributed to musical expression. Also notable was a greater sense of confidence with the ability to be musically expressive.

The successful students' responses were consistent with musical results experienced and described by Caplan (2009), Harscher (2010), and Malde (Malde, Allen & Zeller 2009). Harscher (2010) articulates an expanded technical facility in his playing derived from re-mapping the shoulder blades and hands. Malde's (2009) integration of BMG with her vocal technique produced more consistent technical results and increased her ability to execute technically demanding passages. Participants' improved technical facility attributed to biomechanical ease was congruent with the experiences of BMG teacher-performers. Caplan's (2009, p. 92) description of a student's playing included expressive elements such as a 'forward-moving phrase with a rich, resonant sound.' This resulted from free arm movement when playing the oboe and was achieved by re-mapping the arms.

By contrast, the perceptions of the students in the *minimal RG* were generally negative in relation to enhanced musical expression at this stage of their development. Within this *RG* the student's responses were individualized. For example, while Alison and Vance were both negative, Vance's response hinted as the possibility it would in the future. In Rachel's case she believed BMG had improved her expressivity from an acting standpoint only and she cited her experience with the opera as an example. For these students, Vance in particular, this raises the question about time-frame and progress. Within this research study, the results were confined to a period of 15 weeks (one academic semester). However, the question 'would the students' outcomes have been significantly different if they had more time to cultivate their Body Mapping skills?' arises. The issue of time-frame in relation to the successful application of somatic skills is certainly worthy of further investigation in future studies.

Informant	Function/s BMG played
Good results group	
Susan 'yes definitely'	Feeling free; grounded; more expressive arm gestures; better sound (warmer & more rounded); ability to focus on what's important
Sonya 'oh definitely'	Confident in ability to mentally relax and focus on playing; knowing where to go within herself to find what she wants to express
Natalie 'yes without a doubt'	More confident as a musician; able to think of musicality and not worry about little things; more involved when playing; more musical
Adelaide 'yes'	Knowing how to use my body as an instrument in a really nice way
Amy 'yes'	Able to move and keep a nice tone; phrasing easier; more involved when playing;
Howard 'yes – very much so'	Connecting breath with phrasing when playing; finding it more natural to be dynamic (move)
Reasonable results group	
Tyler 'it is presently'	Physical apparatus facilitates my emotional connection
Ingrid 'yes'	Not as much tension so I can sing more easily; automatically easier to do what I want expressively (e.g. dynamics)
Andrew 'yes'	Being expressive in correct (healthy) ways; confident with dynamic range
Minimal results group	
Alison 'I don't think so yet'	
Rachel 'yes and no'	Able to embody my opera character from an acting standpoint
Vance 'I think it will'	I do see its [BMG] possibilities, both in myself and in others, it's not something I experience every time... not yet

Figure 1. Body Mapping and ability for musical expression

In response to the interview question, 'Has BMG enhanced your ability for musical expression?' all six students in the *good RG* had strong, affirmative responses. A good example was Natalie who reported how she was freed to think musically because of the improvements in her physical balance and overall confidence.

Yes. Without a doubt... I think it's made me more confident as a musician. I think when I used to play just thinking about everything else and my posture and my neck and my shoulders, that when I know I'm in balance I can think of the musicality of the pieces and not worry about the little things. So I think it has helped a tremendous amount... I think I am more involved. I think I've become more musical with the pieces that I've been working on (Natalie, interview).

Natalie's studio teacher supported her positive self-assessment with the comment 'that's fair and clear' (Patricia, interview).

In the *reasonable RG* all three students were also positive that BMG had enhanced their ability for musical expression. Tyler discussed improvements to his technical ability which facilitated his emotional expression. Andrew explained how he had confidence in his ability to use his body correctly and without injury to achieve his expressive goals and play a full dynamic range. Ingrid cited a recent choral singing experience where she experienced ease of expression resulting from the absence of tension, something she had previously struggled with a great deal.

...it definitely helped in that I can sing more easily, there's not as much tension so... automatically it's just easier to do the things I want to do especially expressively... I sang 'Crucifixus' and I was surprised actually at how easy it was just for me to let go and be able to sing... (Ingrid, interview).

In the *minimal RG*, all three students reported they had not had sufficient practical experience with BMG to feel that it enhanced their musical expression. However, Vance did comment favorably on the potential he saw for his own singing in view of the improvements he had witnessed in a number of his peers when he said '...I feel like it really could. Especially seeing what other people have done with it and how much it's helped their musical sound and their perception of music, I know it's possible' (Vance, interview).

Technical Development and Training

A musician's technical development is achieved over a long period of time and is influenced by a range of elements. This has been documented in research by Ericsson (cited in Ackermann 2010) and Ericsson, Krampe, and Tesch-Römer (1993), which places the acquisition of professional-level musical performance mastery at 8,000 to 10,500 hours of practice. A person's age will also determine physical maturity, which has consequences for strength and coordination on an instrument (e.g. piano and cello), or their physiological development, which is crucial in the case of singers. During their lifetime, the majority of musicians will spend more hours developing and refining their technique and musicianship

than actually performing in public. For student musicians, the ability to understand the connections between technique and performance skills is paramount. Figure 2 summarizes the responses regarding changes in technique as a result of BMG.

The most common theme across the participants was a better understanding of breathing. This insight was cited across a range of performance areas including singing, violin, piano, bassoon, and conducting. This underscored a belief in the consequences of effective breathing within performance areas where breathing was not previously considered to be of technical importance (e.g. violin, piano and conducting). BMG contributed to better coordination, flexibility, enhanced arm movement, and improved articulation. These outcomes were consistent with results indicated by Caplan (2009), Johnson (2009), and Vining (2008). For example, Caplan (2009, p. 21) describes the inability to breathe easily and inflexibility of embouchure in oboe playing as consequences of excessive muscular tension in the neck and poor alignment. However, musicians who cultivate balance in their playing may remedy these problems and experience a 'reactive tongue, buoyant arms and free fingers.' Similarly, Vining (2008) describes improvements in breathing function and resultant tone with trombone technique resulting from effective coordination and engagement of breathing structures. Johnson (2009, p. 133) acknowledges that violinists do not require as refined a body map as singers, wind and brass players, however, she emphasizes the importance of accurately mapped breathing to enable 'balance around the core and freedom for the arms.'

In the *minimal RG*, Rachel and Vance were able to identify areas they were working on, and Alison indicated awareness of what she should change. This confirmed their conceptual understanding but inability to apply it in practice. Nonetheless, metacognitive skills as described by Hallam (1997, 2000) were evident in their learning process. For example, the way Rachel and Vance described progress with their breathing technique indicated recognition of strengths and weaknesses. All of them expressed awareness of what they knew was and was not working technically.

Informant	Function/s BMG played
Good results group	
Susan	Released jaw; vibrato more even; free neck; keeping arms loose; upper body not frozen; better breath support
Sonya	Understanding breathing and how it relates to violin playing, especially bowing;
Natalie	Improved tone; significantly better breathing; some articulation improvements
Adelaide	Whole arm movement enhances speed, dynamics (especially playing louder); better breathing that keeps me from getting locked up
Amy	Improved intonation; better air flow;
Howard	Free legs (better coordination) from good balance; trying to be more relaxed (in attitude); slowing down and being patient when practicing; achieving subtle differences in articulation
Reasonable results group	
Tyler	More flexible; letting me realize where the physical limitations are (e.g. fingers, breathing)
Ingrid	Understanding breathing correctly and finding improvements in ability to 'let go' when singing
Andrew	Holding instrument and seated balance but unable to do it consistently yet; articulations and breathing are alright
Minimal results group	
Alison	I wouldn't say that I've change my technique... but I'm aware of what I should change
Rachel	Opening up the voice more (chest voice); still struggling with noisy breaths
Vance	Sound is less inhibited when balanced and moving correctly; more cognizant of my breathing; more alert

Figure 2. Body Mapping and Technical Development and Training

Musical Performance Ability

The quality of a musical performance is dependent on the result of a person's technical facility, musical imagination, and emotional engagement. Whereas technical development is

process, performance is product. The majority of students confirmed that BMG changed their approach to performance. Throughout the literature, performers such as Caplan (2009), Harscher (2010), Johnson (2009), Malde (2009), and Vining (2008) describe improvements in their performing resulting from the integration of BMG skills. Examples include the ability to be poised and responsive in performance, fluid movement, and confidence with the ability to engage musical ideas due to physiological ease. Data in the current study shows that student experiences often mirrored these improvements although not to the same degree of sophistication. This is due to the fact that these musicians are all experienced professionals who have spent many years integrating and refining BMG with their musical technique. It is therefore reasonable that the students' experiences in this study were more modest by comparison.

Greater confidence was a frequent element of student experience; so too the ability to retain focus during the pressure of performance. There were also indications of feeling more centered or grounded, which led to more artistic freedom. A number of students stated BMG changed the way they prepared prior to going onstage. Figure 3 summarizes the students' perceptions. It also highlights the differences between the *RG's*, with the students in the *good* and *reasonable* citing stronger connections. The main difference was the way students in the *minimal RG* tried to apply BMG in performance. Mindful of their stated inability to using BMG for musical expression, their performance applications were predictably limited to discussion about how they were trying to work with BMG rather than actual performance outcomes. Interestingly, both Rachel and Vance spoke in terms of BMG and acting/theatrical applications rather than music. Lehmann and Davidson (2002, p. 552) describe 'inspired performance' as resulting from 'extensive and easily operationalized knowledge.' Cultivating the physical and mental skills to achieve this performance state takes considerable time and effort. Thus performance is a task that requires successful skill integration on multiple levels. While the performance experiences in the study were limited by the time-frame, nonetheless the majority of students found them enhanced from perceptions of being better prepared, more grounded, focused, confident, and aware.

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Informant	Function/s BMG played
Good results group	
Susan	It's changed the way I approach a performance, i.e. having my instrument ready to go way ahead of time; I can do whatever I want when I'm on the stage
Sonya	It [BMG] centers me, grounds me and has provided a framework so that I can logically go about something without freaking out...it helps me to focus on details, just noticing things in my body...
Natalie	I'm more confident to go out and play; as far as anxiety, I didn't have one nerve in my body...I kind of had fun on stage; I had a feeling like a positive anxiety...it was marvelous – I had a great time
Adelaide	BMG is helping me in my performance – once you are the artist you have a lot to take care of and a lot to be responsible for and a lot to find out about – and BMG plugged very nicely into that
Amy	At the band concert...I was able to move freely; I was successful in shifting my focus between music and body awareness – it [BMG] aided me to do that
Howard	BMG has mostly changed the way I prepare for performance – I basically try to be more patient with myself and sort of let the music happen, as opposed to forcing it
Reasonable results group	
Tyler	BMG has absolutely changed my approach to performing; I become conscious of it when I'm correcting something that's wrong which I felt is a success because I felt before I wouldn't have even noticed it was wrong; in my senior recital...I managed to be so connected to the music that I was putting out the fires and maintaining what the people who weren't lost needed to see
Ingrid	BMG's make it [performance] a whole lot less mysterious; I've been trying to channel whatever energy I have into using my body the best way; it's allowed me to explore the practical...and see what you actually have to do to be able to make sound
Andrew	I feel more comfortable going into a performance because I have more things to work with; I'm more willing to openly take the risk of being musically expressive
Minimal results group	
Alison	In rehearsals...I would try and incorporate it [BMG] and...I was way too concerned about it, totally detached from what was going on...
Rachel	It's easier for me to approach my body when acting... I'm more able to find a

	place where I can change my body in order to fit the character
Vance	I think it [BMG] solidified things... its drawn together things that I knew and then added a whole lot; what I do before performances has completely changed - I stretch myself, I try to get everything very aligned, I'll do breathing...I try to get it into some kind of rhythm

(Sources: student interviews)

Figure 3. Body Mapping and Musical Performance Ability

Self-awareness

There was a gradual evolution of self-awareness in the students’ experience. It was fostered through self-reflection, a process that required students to analyze and evaluate their observations during the re-mapping process. Increased positive self-awareness was illustrated through students’ journal entries, in-class interactions (e.g. questions, comments, final performance-presentations) and *Agenda Helper* responses. This was also evident in interview comments they made regarding their technical development and practical situations e.g. rehearsals, master classes, and performances. Because self-awareness must be developed gradually it was initiated in the first class and fostered through course content and instructor-researcher demonstrations. Constructive rest sessions and other self-reflection activities were also utilized. In addition to accurate comprehension of BMG information, the instructor-researcher emphasized the importance of continually cultivating attention when integrating theory into practice.

Cultivating self-awareness skills allowed students to make sensory connections (kinesthesia, sight, touch and sound) with cognitive information, which produced more efficient movement. Harscher (2010) describes how discerning the cause-and-effect of shoulder blade re-mapping element facilitated numerous mapping discoveries. The role of self-awareness is evident when he explains how his initial shoulder blade re-mapping led to subsequent understanding about the structural and functional relationship with his hands and ultimately, his awareness of tension patterns that inhibited his playing.

At the beginning of the study, students were often surprised that their physical habits required such careful and repeated attention. However, once the students understood how mindfulness benefited them, they turned their attention to the challenge of cultivating awareness. A range of issues were identified by the students with regard to developing self-awareness, including: 1) finding solutions to technical challenges; 2) understanding how tension inhibited movement; 3) greater awareness of the consequences of movement patterns on symptoms of pain; and 4) understanding what they were actually doing physically in a range of musical and

every-day activities. Exhibiting skills such as focused attention are aligned with types of self-control found in the second phase of the self-regulated learning cycle described by Zimmerman and Campillo (2001). McPherson and Zimmerman (2002) explain the ability to utilize a variety of techniques to facilitate attention as a hallmark of self-regulated learners.

Within the BMG literature the term *inclusive awareness* is synonymous with *attention* and *mindfulness* and is defined by Conable (2000) as the ability to be simultaneously self and world-perceiving. It must be noted that the BMG description of self-awareness differs from McPherson and Zimmerman's (2002) description in self-regulated learning. McPherson and Zimmerman (2002, p. 341) describe the ability to 'block out distractions and concentrate more effectively' as the means by which students focus their attention. By contrast, Conable (2000), Johnson (2009), Malde, Allen and Zeller (2009), Mark (2003), Pearson (2006), and Vining (2008) specifically advise students against concentrating because it directs attention to a single object or activity and consequently limits the broader field of awareness that is crucial for effective musical performance. Instead, students of BMG are taught to *focus* attention, which results in more flexible mental functioning. Despite the difference in definition, the desired result via self-regulated learning and BMG is essentially the same. Students with the ability to control and direct their attention in the process of learning and remain committed to achieving the end result.

The rate at which students in this study were able to develop their skills in self-awareness varied according to the individual, as did their ability to maintain it. The clearest indications of their progress were evident in journal entries. By the end of the semester, the instructor-researcher noted most students understood the importance of cultivating self-awareness for effective body use even though their ability to consistently achieve it varied. More deliberate choices were evident in interview conversations. For example, Andrew's statement 'I'm not going out of my way to injure myself to make this gorgeous phrase and then walk out of the room with my arm dangling at my side because I can't do anything with it anymore' was a significant paradigm shift. Andrew had played Euphonium with a degree of pain for many years and was no longer prepared to accept this as normal. Through his new-found awareness Andrew was able to monitor his use and regulate his movement choices accordingly.

Conclusions

Understanding the impact of BMG on the students' perceptions of their performance and development was achieved by analyzing their experiences over the course of a semester. In the final analysis, this study confirmed a number of things. Firstly, the majority of study participants believe BMG enhanced their ability to be musically expressive, citing specific examples such as dynamic control, sensitivity to phrasing, and improved emotional communication. Secondly, BMG improved understanding of specific technical elements as

they applied to their performance area. These included richer tone quality, even vibrato, improved breath support, clearer articulation, and enhanced ability to handle faster tempi and louder dynamics, and improved intonation. Across all study performance areas, breathing technique was more clearly understood as a result of engagement with BMG information.

Thirdly, as performers, the students in the *good* and *reasonable RGs* (comprising a total of nine of the twelve participants) described themselves as more confident, grounded and more focused during the intensity of performance. Fourthly, irrespective of their personal performance outcomes, all of the students in this study gained an appreciation for the importance and relevance of BMG technique for musicians. This derived from their understanding of the relationship between movement and sound. Further, many of them experienced increased ease of motion in their physical use at some stage in the semester.

Within the fields of music education and performance, the study confirms the importance of accurate biomechanical movement education in the training of musicians at all levels. There is evidence of growing awareness and acceptance about the risks associated with musical performance in both the musical and health communities. Given the high incidences of playing-related pain and injury among performers of all levels, there is still a great need for this agenda to be emphasized. Success in this regard will be measured by statistics that confirm a generation of musicians who play with technical ease and freedom from pain and injury. However, it is incumbent on music educators to be the first and last line of defense. Gary Graffman clearly articulates this in his statement ‘I think the most I can do as a teacher is to make sure that my students learn to be aware of what they are doing... For it is really only through education – and thus prevention – that we can keep these physical problems at bay’ (Graffman quoted in Sataloff, Brandfonbrener and Ledermann 2010 p. ix).

These study results also have a number of implications for pedagogy and teaching, particularly the compatibility of BMG instruction in other musical settings. Within the range of somatic education methods currently available, BMG is the only technique with a predominant focus on the movement needs of musicians. Since its inception BMG has been taught in a variety of musical environments, ranging from one-on-one instruction in a studio, to instrumental and vocal ensembles, and other large-scale classroom settings. The dissemination of BMG information and practical critiques in a group classroom setting is confirmed to be effective from the results of this study. Moreover, study participants stated they subsequently transferred the BMG learning into a variety of musical settings including studio lessons, ensemble rehearsals and performances, opera performances, solo recitals and juried examination performances. The students’ frequent successes practicing BMG in other musical contexts confirms that BMG information can effectively transfer into other areas of instruction.

As a result of the outcomes from this study, a range of future research directions emerged as significant for BMG as a discipline and in combination with other areas of interest to musicians and researchers. They include the following which could be considered individually or in combination: other populations of musicians, e.g. professionals, school-age children, and amateur musicians; specific performer groups, e.g. violinists, singers, pianists, etc.; a larger informant pool; different BMG time-frames and teaching-learning environments; longitudinal studies; self-regulated learning; *results group* typology; and in collaboration with scientific researcher, specifically neuroscience and studies involving functional magnetic resonance imaging (fMRI). A study from a constructivist perspective also merits consideration and would provide insights into how musicians' understanding of BMG is constructed not conveyed. For example, it could investigate how learners construct understanding from the ways they experience phenomena, how they interpret experiences, how they reason about them, and ultimately engage in processes of reflection.

A deconstruction study along the lines of research by Lehmann and Davidson (2002) may also provide information for assessing the potential for BMG to assume a role in the development of students' cognitive functioning, and explore its contribution to successful teaching and learning outcomes. A further issue surrounds teachers who are the people most likely to influence a student's introduction to BMG. Two questions about teachers deserve investigation; i) how are teachers introduced to BMG?, and ii) how do they come to accept the pedagogy of BMG? The final issue pertains to students and the need to deconstruct how those who become committed to BMG develop their focus, while concurrently realigning, readjusting, or rejecting previous pedagogical frameworks they were using. Finally, two music-related topics that would provide valuable data on the impact of BMG are performance anxiety and playing-related pain and injury.

More BMG studies will benefit musicians, educators and healthcare practitioners committed to meeting the needs of musicians. In the meantime, this study provides a foundation for future research into BGM as an education technique, with particular emphasis on its benefits for the educational and musical requirements of performers of all ages.

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